Capturing Leadership: Policies for the US to Advance Direct Air Capture Technology

John Larsen
jwlarsen@rhg.com

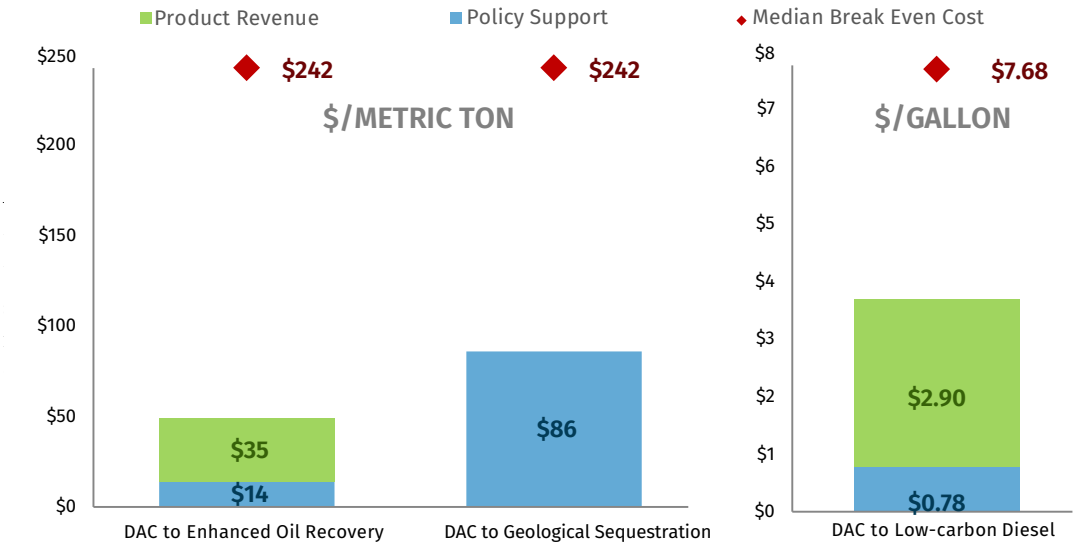
Whitney Herndon
wjherndon@rhg.com

The US has a long track record of leading the world in technological innovation, and a unique opportunity to be a frontrunner in innovative carbon dioxide removal (CDR) technologies. *Capturing Leadership* focuses on one of these emerging technologies: Direct Air Capture (DAC).[1] DAC safely removes excess carbon dioxide (CO_2) from the air using chemical filters and produces a concentrated stream of CO_2 for use in products like concrete and fuels or for permanent geologic storage deep underground. With assets such as vast CO_2 pipeline infrastructure, proven enhanced oil recovery capacity, and more than 2 trillion tons of geologic storage, the US is well-positioned to foster development of DAC with sequestration (DACS). Fortunately, thanks to recent breakthroughs, the pathways to doing so are increasing in number and falling in cost. But just as is the case for other critical low-carbon technologies like nuclear and carbon capture and storage, significant federal policy action is required to ensure the DAC technology is available in time and at the scale to contribute to avoiding the worst impacts of climate change.

DAC Deployment Is Achievable, and Technology Is Set to Break Through

Investing now in research and development would set the US on track to innovate and improve DAC technology today so it's ready for deployment when we need it most. Collectively, commercial DAC companies have built 11 DAC plants around the world. However, while some niche opportunities may exist now where DAC is economic, current market opportunities and policy incentives do not provide enough support for the first large-scale DAC plant to break even. This is the case across multiple DAC technology applications, even after accounting for existing policy incentives like California's Low Carbon Fuel Standard (LCFS) and the Federal Section 45Q tax credit (Figure 1). Drawing on the historical deployment pathways of key electric power sector technologies, such as natural gas combined-cycle power plants, wind, and solar, we find evidence to demonstrate the potential for policy to propel DAC to market with great success. The US has done it before. It can be done again.

FIGURE 1.
DAC costs exceed current revenue opportunities
30 year $2018 levelized values



Source: Rhodium Group analysis. Note: Costs are for a first-of-a-kind megaton scale plant.

1 Carbon180, The Linden Trust for Conservation, and the ClimateWorks Foundation asked Rhodium Group to conduct an independent analysis of the role DAC can play in supporting a decarbonized US future, its cost, and the actions required to achieve deployment at a scale that can impact global emissions.

Tel: +1.212.532.1157
Fax: +1.212.532.1162
Web: www.rhg.com

New York
5 Columbus Circle
New York, NY 10019

California
312 Clay Street
Oakland, CA 94617

Hong Kong
135 Bonham Strand
Sheung Wan, HK

Paris
33 Avenue du Maine
75015 Paris

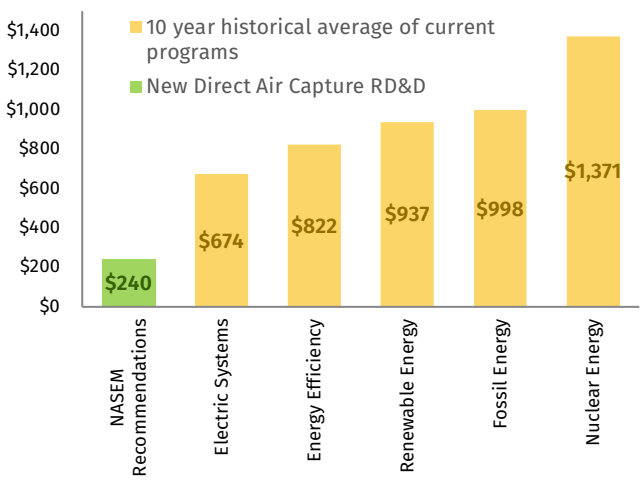
Federal Actions to Foster DAC

To become a leader in DAC technology, the US must prioritize the construction of DAC plants to increase scale and reduce costs through learning and experience. We estimate that at least nine million tons of DAC capacity need to be operational in 2030 to get the US on track for meeting mid-century CDR requirements. To ensure this happens, the federal government can pursue policy action on multiple fronts.

Enact and Fully Fund a Comprehensive Research, Development, and Demonstration (RD&D) Program

Among its developed-country peers, the federal government ranks in the middle of the pack in energy RD&D relative to the size of the economy. Meanwhile, the cumulative amount of government funding for DAC RD&D to date is only $11 million. The landmark study of negative emissions technologies by the National Academies of Sciences, Engineering, and Medicine (NASEM) recommends funding DAC research over the next ten years. Compared to DOE spending on every other applied energy RD&D program, this sum would be small (Figure 2). Congress should authorize comprehensive DAC and sequestration research programs that reflect the recommendations from the NASEM, enact them into law, and fully fund them through appropriations.

FIGURE 2.
NASEM average annual recommended federal funding for DAC and current DOE programs



Source: NASEM, Congressional Research Service and Rhodium Group analysis.

Pursue Policy Pathways to Increase Demand for DAC

While RD&D is essential, a comprehensive industrial strategy should also stimulate demand for DAC technology. We assess three pathways for the federal government to do this based on existing policy frameworks and then quantify the level of support required. Fully implementing any one of these pathways should get DAC on track towards likely long-term deployment needs. These pathways include:

1. Leverage Federal Procurement. The Department of Defense can ramp up competitive procurement of DAC based fuels from zero to roughly 23% of 2017 operational fuel consumption in 2030. The General Services Administration can launch a competitive procurement program for carbon removal from DAC with sequestration in addition to procuring low-carbon products made with DAC CO_2.

2. Improve the Section 45Q Tax Credit for DAC. Congress can make several improvements to this program all focused on DAC: extending the commence-construction deadline for DAC eligibility to the end of 2030; extending the credit payout period to 30 years; increasing the value of the credit for geologic storage to $180 per ton; and lowering the minimum capture and use thresholds to 10,000 tons per year. The total annual cost to the government in 2031 would be just $1.5 billion, roughly half the current annual cost of solar photovoltaic (PV) tax credits.

3. Establish a Federal Mandate for DAC Based Fuels. Congress can expand eligibility for the Renewable Fuels Standard or establish a standalone mandate for very low-carbon, drop-in fuels to increase consumption of DAC-derived fuels. By 2030, DAC-derived fuels need to equal roughly 0.4% of 2017 US on-road fuel consumption to achieve the goal of nine million tons of DAC capacity.

Overcome Non-Cost Barriers to DAC Deployment

The federal government should act to address long-term geologic storage monitoring and liability to provide certainty to project developers pursuing DACS. Streamlined pipeline and CO_2 storage permitting can reduce costs and investment risks. The government should also facilitate sequestration projects by mapping geologic formations and assessing their suitability. Independent standard-setting organizations should proactively establish standards for CO_2-based products such as concrete and aggregate, removing a key market barrier.

Lower the Cost of Investment

We assessed several existing federal policies that reduce the amount of investment required to finance DAC plants including Loan Guarantees, Master Limited Partnerships, Private Activity Bonds, and Investment Tax Credits. Congress should pursue an Investment Tax Credit of 30% for the most effective strategy to complement deployment policies. This approach is also well-proven, having been used to drive the rapid rise of solar PV deployment.

Leverage Opportunities in Infrastructure or Energy Policy

Many policy frameworks focused on other goals could be designed to provide support to DAC. An infrastructure bill could be used to increase demand for DAC-based products like concrete; Clean Energy Standards can incorporate offset mechanisms to support DAC, similar to provisions currently in place in California's Low Carbon Fuel Standard.